

SECTION V.—SEISMOLOGY.

RESUMPTION OF SEISMOLOGICAL WORK.

By C. F. MARVIN, Chief of Bureau.

[Dated, Weather Bureau, Washington, D. C., July 1, 1914.]

Authority having been granted by Congress for the Weather Bureau to conduct seismological work, to begin with July 1, 1914, this work will accordingly be resumed.

As but limited funds are available for inaugurating the work, it will consist at the beginning of a systematic collection of noninstrumental reports, to be rendered on postcards or other appropriate form, giving the essential features of such slight earthquakes as are likely to be felt in almost any part of the United States. Particular attention will be paid, however, to the Pacific coast and Rocky Mountain regions; the Mississippi Valley in the vicinity of Missouri; certain parts of New York State and New England, and possibly the region in the vicinity of Charleston, S. C.

It is believed that by the collection and study of numerous reports of this character it will be possible to locate sections of the United States where seismic motion on existing fault lines is taking place with some frequency and regularity. The location and mapping of these points of weakness are of great importance in the conduct of certain kinds of engineering work, especially those relating to great water-supply projects or similar engineering undertakings where it is necessary to provide against injuries resulting from possible earthquake motions.

The development of the work along instrumental lines, which will proceed as rapidly as funds permit, contemplates the establishment of a limited number of instrumentally-equipped stations that will serve to yield record not only of sensible seismic phenomena, but also of the great unfelt vibrations resulting from large distant earthquakes.

The seismological work will be under the supervision of Professor William J. Humphreys.

SEISMOLOGY.

By W. J. HUMPHREYS, Professor of Meteorological Physics, in charge of Seismological Investigations.

[Dated, Weather Bureau, Washington, Feb. 1, 1915.]

HISTORICAL AND INSTRUMENTAL.

Although earthquakes have so appealed to the imagination as to command a prominent place in mythology, in tradition, and on the pages of all authentic history, nevertheless the science of such phenomena instead of being old like astronomy and geometry is one of the youngest. Noninstrumental records of earthquakes have it is true, been kept in Japan and Italy for many centuries, and even ingenious devices that would indicate the occurrence of disturbances were set up in China nearly 1,800 years ago, yet modern seismology, the science of earthquakes and the interpretation of their many phenomena, is indeed so very modern as to require considerable liberality in conceding it an age of even 30 to 40

years. It began only with the use of apparatus so designed and constructed as to record the times of beginning and ending of every material tremor, even though not sensible to man, its amplitude, direction, period, and other characteristics. As these instruments have increased in number and distribution throughout the world our knowledge of the structure of the earth, both in the outer shell and in its deeper portions, has become more abundant and more specific.

The designing of apparatus that will record the onset, the period, the amplitude, and the subsidence of a vibration, often feeble beyond human sense to detect, caused by a break or a slip in the rocky crust of the earth thousands of miles away, in the very antipodes, it may be, challenges, as one may well imagine, the highest type of inventive genius, while its construction and maintenance puts to test the skill of the trained mechanician. Similarly, the interpretation of these records calls for much thought by the geophysicist and the extensive use of none too easy mathematics.

From this it might seem that seismology is an ideal subject for the private diversion of the abstract scientist, as indeed it is. Those who attempt difficult problems for the mere exhilaration they afford, or revel in the luxury of intricate equations, can find in seismology every excuse for endless self-indulgence.

APPLIED OR PRACTICAL.

"To have is to use" is an axiom that applies as well to knowledge as it does to land and chattels. Steam soon moved many things besides teakettle lids. Similarly, the knowledge, so far as that has already been gained, of where earthquakes occur, why they occur, and how the earth vibrates under their shocks, has already found eminently practical applications, and it is quite certain, from the nature of these applications, that they will keep in close touch with the growing knowledge. Thus the fact, now generally recognized, that perhaps all notable earthquakes are due to sudden breaks and displacements in the rocky crust, leads to two important deductions: (a) That each geologic fault, each surface across which the strata are nonconformable or displaced, presumably has been the origin, the focus, or epicenter of from one to many earthquakes; (b) that since, in general, a break remains forever a weak place in the earth's crust, earthquakes are most likely to recur just where they occurred before. The first of these deductions, because it concerns things that have already passed, some of them hundreds, thousands, possibly millions of years ago, can neither command the attention of the engineer nor catch the interest of the man of affairs. The second deduction, however, concerns not the past but the future and therefore has a practical value that increases directly with the frequency with which disturbances recur. Hence wherever seismic shocks are at all frequent, especially in populated portions of the world, a careful engineer would not span an active geologic fault with a bridge, aqueduct, dam, or other important structure if it could be avoided. Neither would a properly informed and prudent banker finance such an enterprise unless the success of the project could be safeguarded.